Computer-Aided Design Methods for Model-Based Nonlinear Engine Control Systems, Phase I

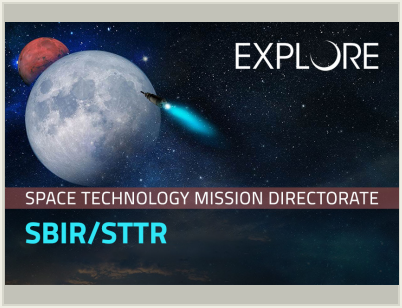
Completed Technology Project (2005 - 2005)

Project Introduction

Traditional design methods for aircraft turbine engine control systems have relied on the use of linearized models and linear control theory. While these controllers can provide satisfactory performance, they do not exploit all the available knowledge about the nonlinear engine dynamics. Recent advances in computer-aided nonlinear control system design technology have made it feasible to design control systems using a detailed model of the engine. These nonlinear engine control systems have the potential to deliver a more precise control of the engine dynamics while satisfying multiple operational requirements. Using a NASA-supplied engine model, Phase I research will develop a nonlinear engine control system that can deliver uniform performance over the entire operating region. Operation at multiple operating points and transitions between them will be demonstrated during the Phase I research. Phase II work will develop a rapid-prototyping design environment for nonlinear engine control systems and real-time controller code generation for implementing the nonlinear control on engine control computer. Advanced engine control concepts such as active clearance control and adaptive engine control will also be demonstrated during the Phase II work. The design software and the control technology developed under the present SBIR will be commercialized during the Phase III research.

Anticipated Benefits

Potential NASA Commercial Applications: Nonlinear engine control systems will be able to exercise a more precise control over the engine dynamics, leading to better engine performance and life. The advanced control architecture may also allow better tradeoffs between engine performance and environmental specifications. The design software developed during the Phase II research will provide a rapid-prototyping capability for nonlinear engine control systems to NASA and aircraft engine developers.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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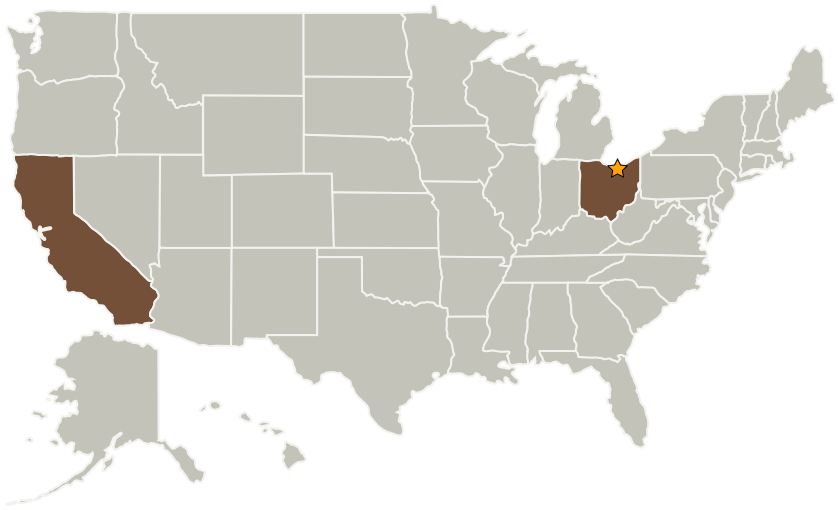
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Optimal Synthesis, Inc.	Supporting Organization	Industry Small Disadvantaged Business (SDB)	Los Altos, California

Primary U.S. Work Locations	
California	Ohio

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

Michael G Ryschkewitsch

Principal Investigators:

Linda Y Cureton
Padmanabhan K Menon
Padmanabhan Menon

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.5 Propulsion Flowpath and Interactions